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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,575	07/31/2006	Toshitaka Shimamoto	OKUDP0176US	3036

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EXAMINER	
FOX, BRANDON C	

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2818	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/597,575	SHIMAMOTO ET AL.	
	Examiner	Art Unit	
	BRANDON FOX	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 April 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) *12-25* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 July 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This is a Non-Final office action based on application 10/597,575 in response to reply filed April 23, 2009. Claims 1-25 are currently pending and have been considered below.

Election/Restrictions

Applicant's election without traverse of Group I (Claims 1-11) in the reply filed on April 23, 2009 is acknowledged.

Claims 12-25 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention/group, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on April 23, 2009.

Drawings

Figures 12 & 13 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1, 4, 6, & 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Kong (US Patent 6,582,986).

Regarding claim 1, Kong discloses a semiconductor device comprising:

- A substrate structure (Fig. 3, 10) with electrically conductivity, and semiconductor multilayer structure (12 & 20) that is supported on the substrate structure.
- Wherein the principal surface of the substrate structure has at least one vertical growth region (See Fig. 3 wherein the upward arrow designates the vertical growth region) which function as a seed crystal for growing a nitride based semiconductor (20) vertically and plurality of lateral growth region (See Fig. 3 wherein the horizontal arrows designates the lateral growth region) for allowing the nitride-based semiconductor that has grown on the vertical growth region to grow laterally.
- Wherein size of the vertical growth region as measured in a first direction and is parallel to the principal surface of the substrate has a length of "L" (See Fig. 1 & Fig. 2) which is greater than the size of the lateral growth

region having a length "W", thereby the inequality of $\sum X/\sum Y > 1.0$ is satisfied.

Regarding claim 4, Kong further discloses:

- The vertical and lateral growth regions on the principal surface of the substrate structure extends in stripes perpendicularly to the first direction (See Fig. 2).

Regarding claim 6, Kong further discloses:

- A mask layer (Fig. 3, 14a & 14b) covers the principal surface of the substrate structure wherein the mask layer includes openings (6) which is aligned with the vertical growth region and the masking portions are aligned with the lateral growth regions.

Regarding claim 7, Kong further discloses:

- The area of the opening of the mask layer is greater than the overall area of the masking portions of the mask layer (See Fig. 1 & 2).

Claim Rejections - 35 USC § 103

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Matsumura (Pre-Grant Publication 2006/0078024).

Regarding claim 2, Kong disclose a semiconductor device comprising:

- A nitride based semiconductor layer (Fig. 3, 20) wherein the semiconductor layer can made of AlInGaN/aluminum indium gallium nitride (See Kong Col. 5, Lines 40-46).
- Kong also discloses in another embodiment the substrate can be made of nitride based material aluminum nitride or aluminum gallium nitride (See Col. 8, 16-17).

Kong does not disclose the substrate is made of AlGaInN. However, Matsumura disclose a semiconductor laser device comprising:

- A substrate (Fig. 1 & 2, 101) wherein the substrate can be made of InAlGaN/indium aluminum gallium nitride (Matsumura Paragraph [0102]).

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Matsumura with that of Kong because nitride based substrates are commonly used in the fabrication of LED and laser devices and the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Further since the aluminum, indium, and gallum are all present then it is inherent that the content for each is at least greater than 0 and it is also common for the summation of the content to equal 1.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Matsumura (Pre-Grant Publication 2006/0078024) and Shakuda (Pre-Grant Publication 2004/0079960).

Regarding claim 3, Kong disclose a semiconductor device comprising:

- A nitride based semiconductor crystal layer (Fig. 3, 20) wherein the semiconductor layer can made of AlInGaN/aluminum indium gallium nitride (See Kong Col. 5, Lines 40-46) and has been grown form the vertical growth region on the principal surface of the substrate structure.
- Kong also disclose a buffer layer (Fig. 3, 12) which has been formed on the upper surface of the substrate body and of which the surface functions as the principal surface of the substrate structure wherein the buffer layer is made of AlGaN/aluminum gallium nitride (See Kong Col. 5, Lines 47-48).

Kong does not disclose the substrate comprises AlGaInN and an immediate layer also comprising AlGaInN. However, Matsumura disclose a semiconductor laser device comprising:

- A substrate (Fig. 1 & 2, 101) wherein the substrate can be made of InAlGaN/indium aluminum gallium nitride (Matsumura Paragraph [0102]).

Shakuda discloses nitride based semiconductor device comprising:

- Buffer layers (Fig. 4, 4 & 5) wherein the buffer layer can be made of AlGaInN (See Shakuda Paragraph [0106]).

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Matsumura and Sakuda with that of Kong because nitride based substrates and buffer layers are commonly used in the fabrication of LED and laser devices and the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Further since the aluminum, indium, and gallum are all present then it is inherent that the content for each is at least greater than 0 and it is also common for the summation of the content to equal 1.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Nagai (US Patent 7,052,979).

Regarding claim 5, Kong discloses all of the limitations of claim 4 (addressed above). Kong does not disclose the vertical growth region on the principal surface of the substrate structure is defined by a striped ridge portion. However, Nagai discloses a semiconductor device comprising:

- Growing a nitride based semiconductor layer (Figs. 5-8, A) on a nitride based semiconductor (B) having striped ridge/projection parts (B1) wherein vertical growth is conducted.

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Kong with that of Nagai because the projection parts serve to reduce stress between the semiconductor layer (A) and semiconductor (B) thereby the reduction in stress also leads to a reduction in dislocations in the semiconductor layer (A) and a reduction in cracks in the semiconductor layer (B) and the projection part also prevents the reaction part (polycrystalline GaN) form being formed (See Nagai Col. 11, Lines 42-67 & Col. 12, Lines 1-9).

Claims 8 & 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Matsumura (Pre-Grant Publication 2006/0078024) as applied to claim 2 above, and further in view of Shakuda (Pre-Grant Publication 2004/0079960) and Kiyoku (US Patent 6,940,103).

Regarding claim 8, Kong disclose a semiconductor comprising:

- Growing an AlGaInN crystal layer (Fig. 3, 20).

Kong does not disclose the multilayer structure including an active layer having a smaller band-gap and a current confining structure for injecting carriers into the active layer. However Shakuda disclose a semiconductor device comprising:

- An active layer (Fig. 4, 7) sandwiched between to two cladding layers (6 & 8) made of AlGaInN having an higher bandgap rate than the active layer (See Shakuda Paragraphs [0100] & [0107]).

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Shakuda with that of Kong because the since the cladding layer have a higher bandgap, carriers fed into the active layer can be trapped between the active layer and the cladding layer thereby increasing the efficiency of light emitted (See Shakuda Paragraph [0100] & [0108]).

Kiyoku disclose a nitride based semiconductor device comprising:

- A n-side cladding layer (Fig. 3, 213) and a p-side cladding layer (218) wherein both are current confining layers for injecting carrier into an active layer (215) (See Kiyoku Col. 22, Lines 10-14 & Col. 23, Lines 58-61).

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Kiyoku with that of Kong because by injecting carriers into the active layer by the current confining layer, light can be produced from the active layer.

Regarding claim 9, Kong, Matsumura, Shakuda, and Kiyoku disclose all of the limitations of claim 8 (addressed above). Kiyoku further discloses:

- Growing a nitride layer (Fig. 1a-1c, 15 & 16) having dislocations (represented by the wavy/bent lines) (See Col. 6, Lines 28-32) wherein

the dislocations/defects are not easily from on the lateral growth regions (See Col. 6, Lines 4-8).

- Kiyoku further disclose the p-side cladding/current confining layer and p-side contact (218 & 219) are provide to form a ridge stripe wherein the ridge stripe is positioned at a location where low defects/almost no crystal defects are present (i.e. the lateral growth regions) (See Kiyoku Col. 41, Lines 13-27)

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Kiyoku with that of Kong because by forming the current confining structure over the lateral growth region/low defect region makes it difficult to cause dislocations of crystal defects from the substrate to the active region during laser oscillation, thereby prolonging the lifetime and reliability of the device (See Kiyoku Col. 41, Lines 21-27).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Matsumura (Pre-Grant Publication 2006/0078024) and Sakuda (Pre-Grant Publication 2004/0079960) as applied to claim 3 above, and further in view of Hatano (US Patent 5,042,043).

Regarding claim 10, Kong, Matsumura, and Sakuda disclose all of the limitations of claim 3 (addressed above). Neither reference discloses at least one of the

mole fractions changes in the thickness direction. However, Hatano disclose a semiconductor laser device comprising:

- An intermediate buffer layer (Figs. 22 & 23, 101, 102, 111, & 112) wherein the intermediate buffer layer is a Group III-V material comprising five elements, wherein the composition changes in the thickness direction (See Hatano Claim 8).

It would have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Hatano with that of Kong because by composition changing in the thickness direction will result in the bandgap of the intermediate buffer layer to continuously changes to effectively smooth a transition region of the band gap between the active layer and the cladding layer (See Hatano Col. 10, Lines 55-61 & Claim 6).

Claim 11 rejected under 35 U.S.C. 103(a) as being unpatentable over Kong (US Patent 6,582,986) in view of Matsumura (Pre-Grant Publication 2006/0078024), Sakuda (Pre-Grant Publication 2004/0079960), and Hatano (US Patent 5,042,043) as applied to claim 10 above, and further in view of Nagai (US Patent 7,052,979).

Regarding claim 11, Kong, Matsumura, Sakuda, and Hatano disclose all of the limitation of claim 10 (addressed above). Neither reference disclose he intermediate layer comprising at least two layers. However Nagai discloses a semiconductor device comprising:

- A first and second nitride based buffer layer (Fig. 8c, B & C).

It would have been have been obvious to those having ordinary skill in the art at the time of invention to incorporate the teachings of Nagai with that of Kong because the buffer layers serve to reduce stress cause from a lattice mismatch between the substrate and the semiconductor layer (A) and also prevent the reaction part (polycrystalline GaN) from being formed (See Nagai Col. 11, Lines 42-67 & Col. 12, Lines 1-9).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRANDON FOX whose telephone number is (571)270-5016. The examiner can normally be reached on Mon - Fri 6:30 - 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BCF
6/30/2009

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Primary Examiner, Art Unit 2818